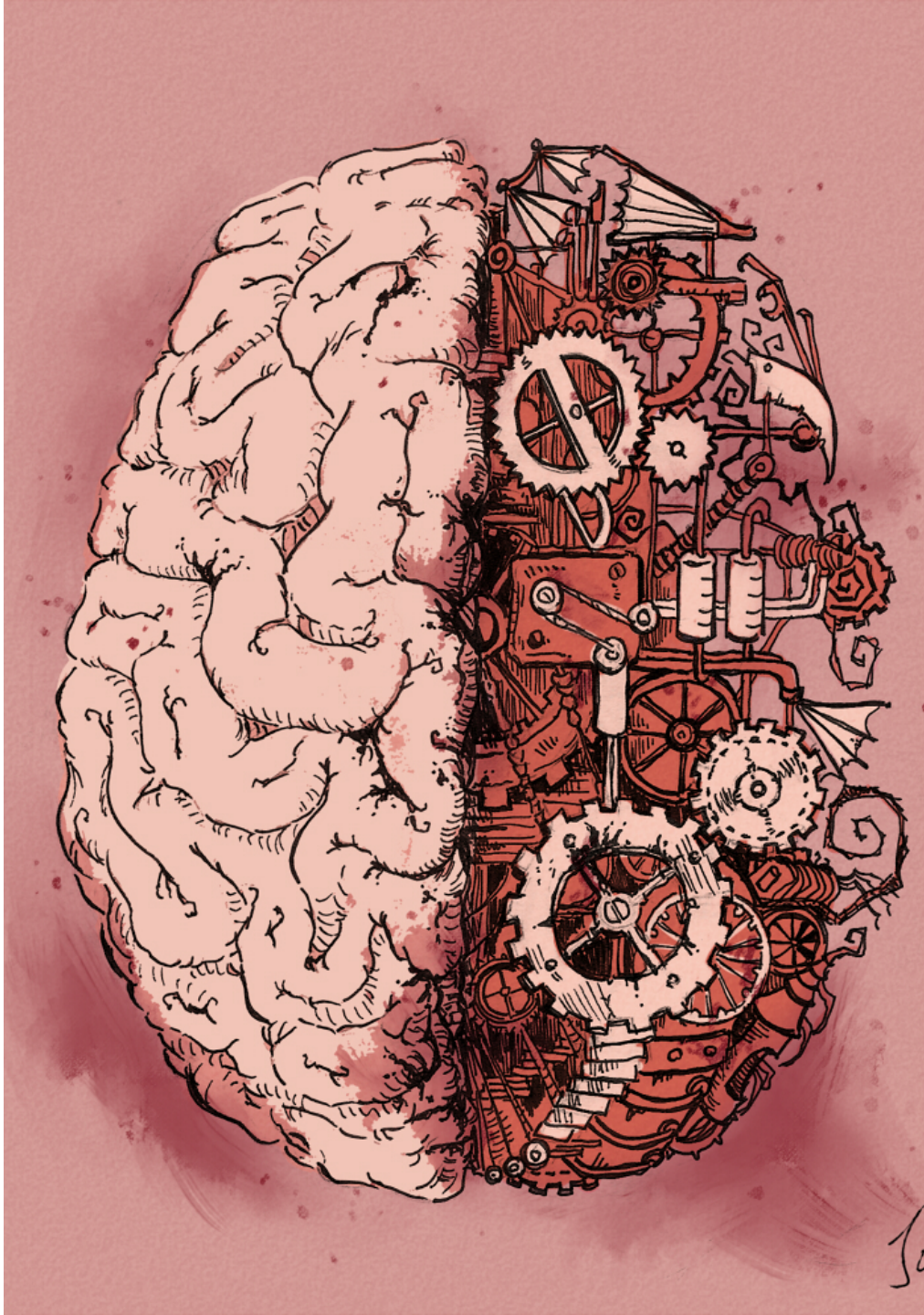
Applied Neuroscience

Columbia Science Honors Program

Fall 2017

Neuroanatomy

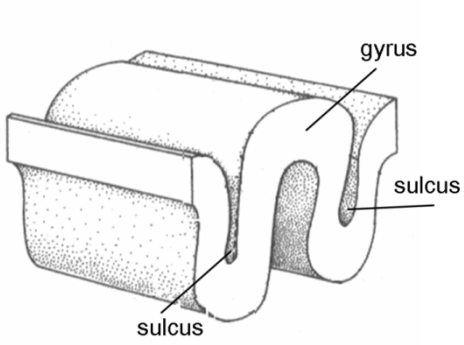


Guest Lecture
by Christos Papadimitriou

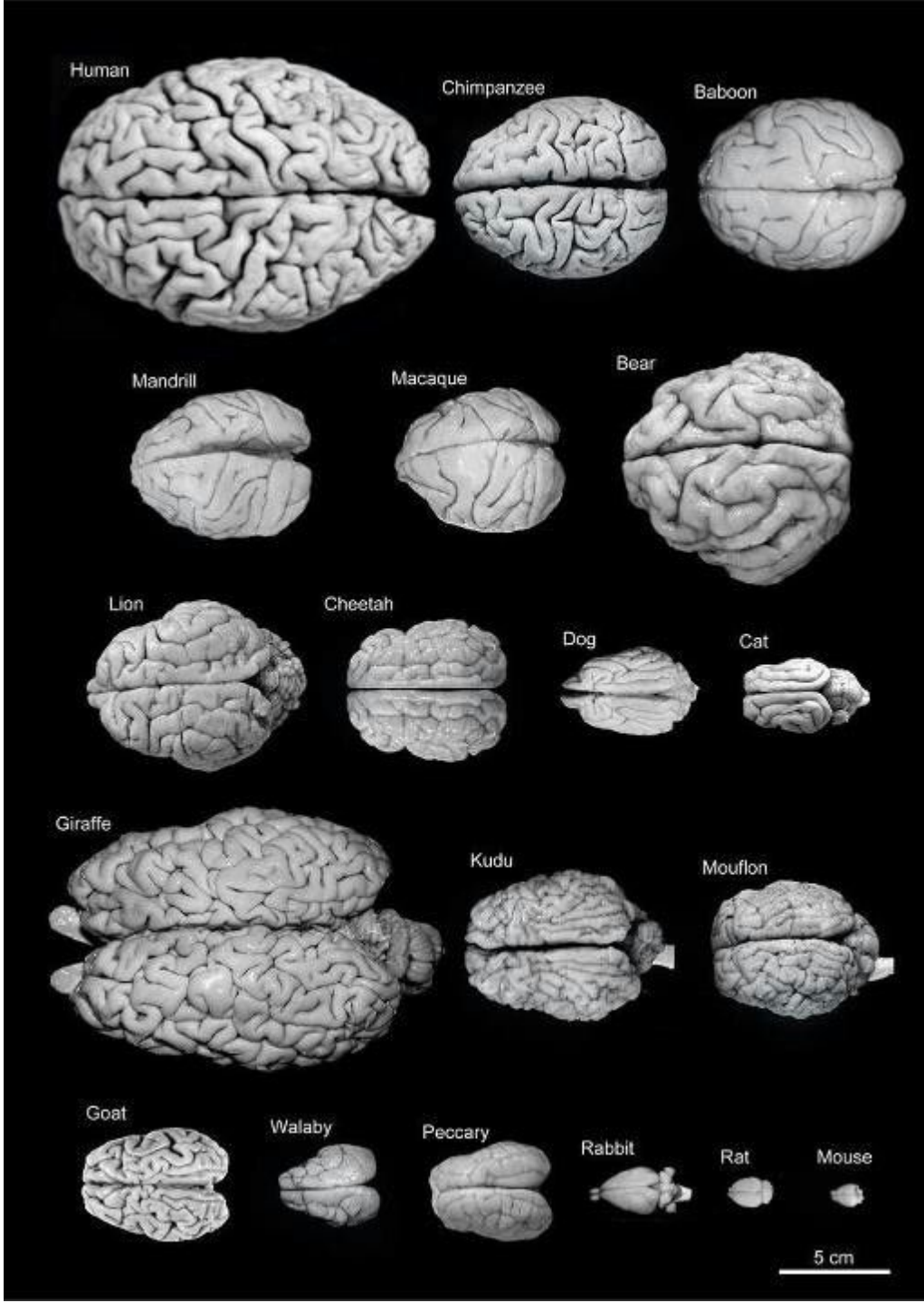
"A computer scientist thinks about the brain"

Demo: Brain Bank

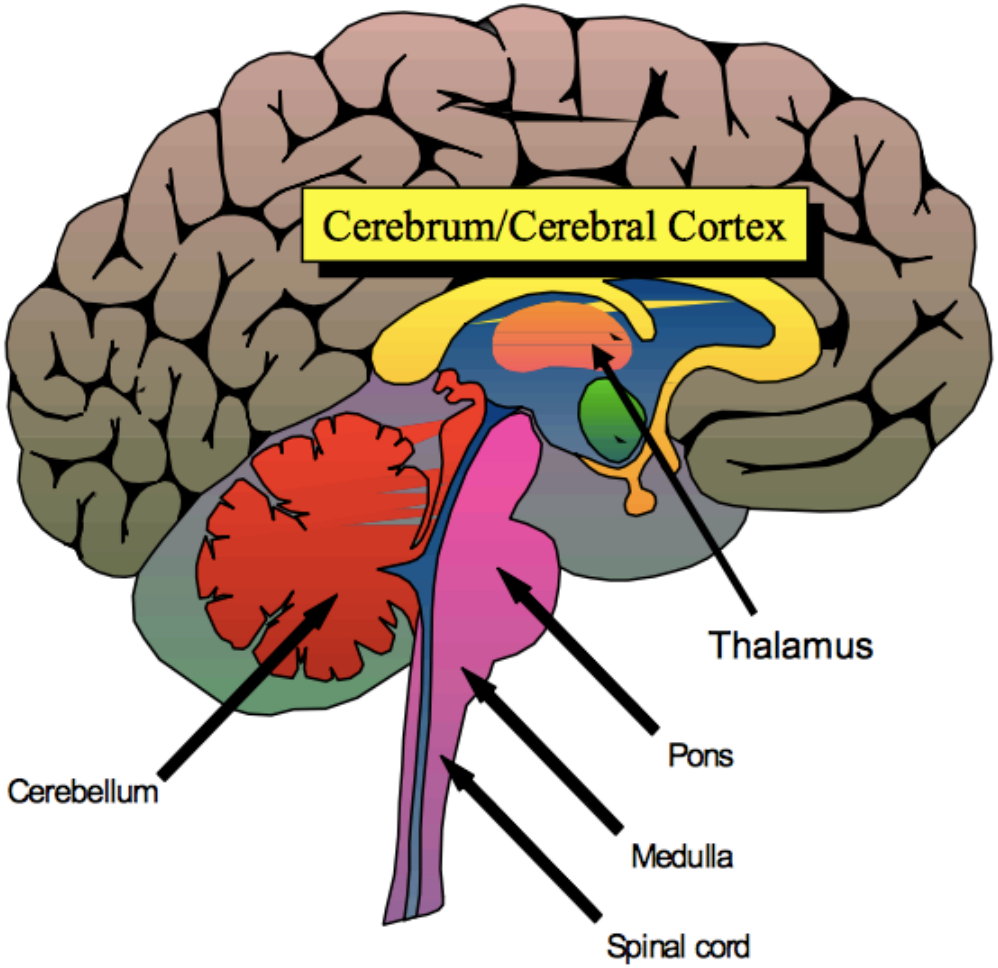
1) Wear gloves
2) Don't remove brains from vials
3) Be gentle!



The folds allow for greater surface area =
better organization of complex behaviors



The Human Brain



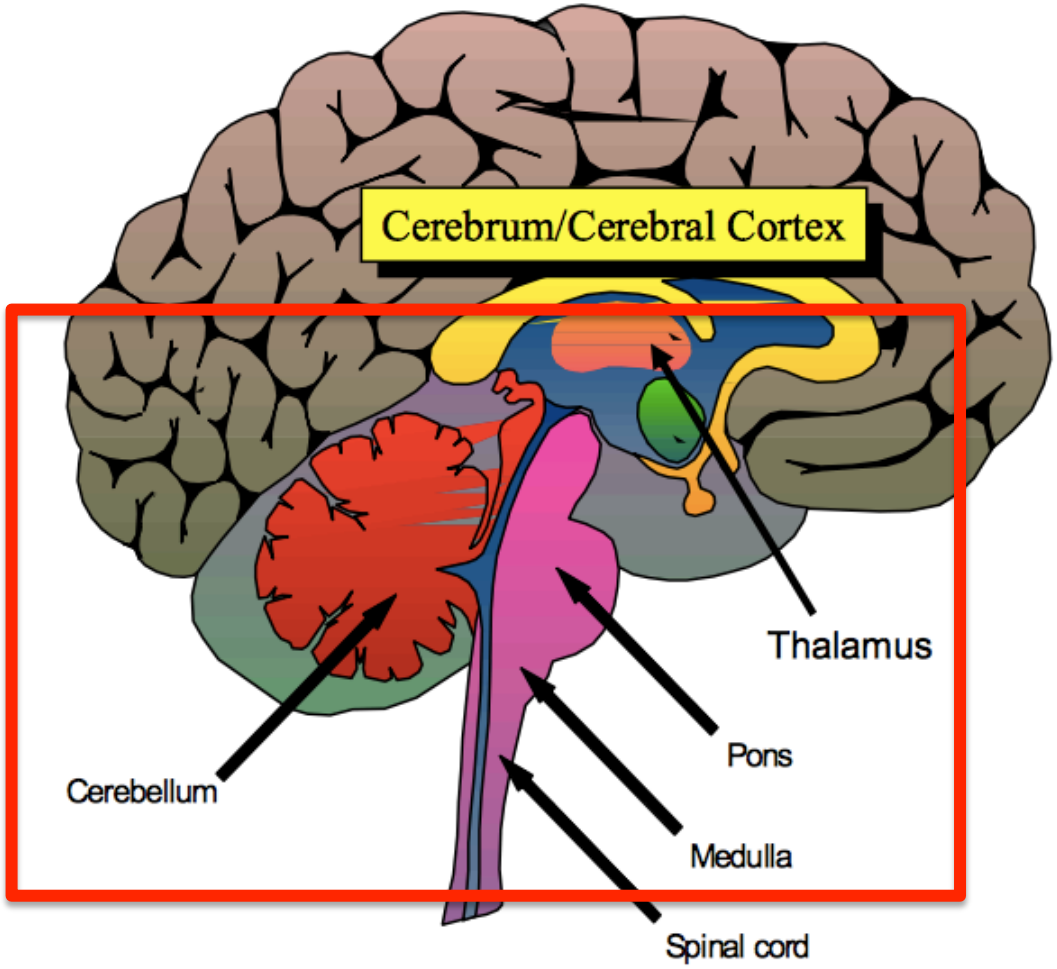
THE BRAIN is wider than the sky,
For, put them side by side,
The one the other will include
With ease, and you beside.

The brain is deeper than the sea,
For, hold them, blue to blue,
The one the other will absorb,
As sponges, buckets do.

The brain is just the weight of God,
For, lift them, pound for pound,
And they will differ, if they do,
As syllable from sound.

Emily Dickinson

Major Brain Regions: Brain Stem and Cerebellum

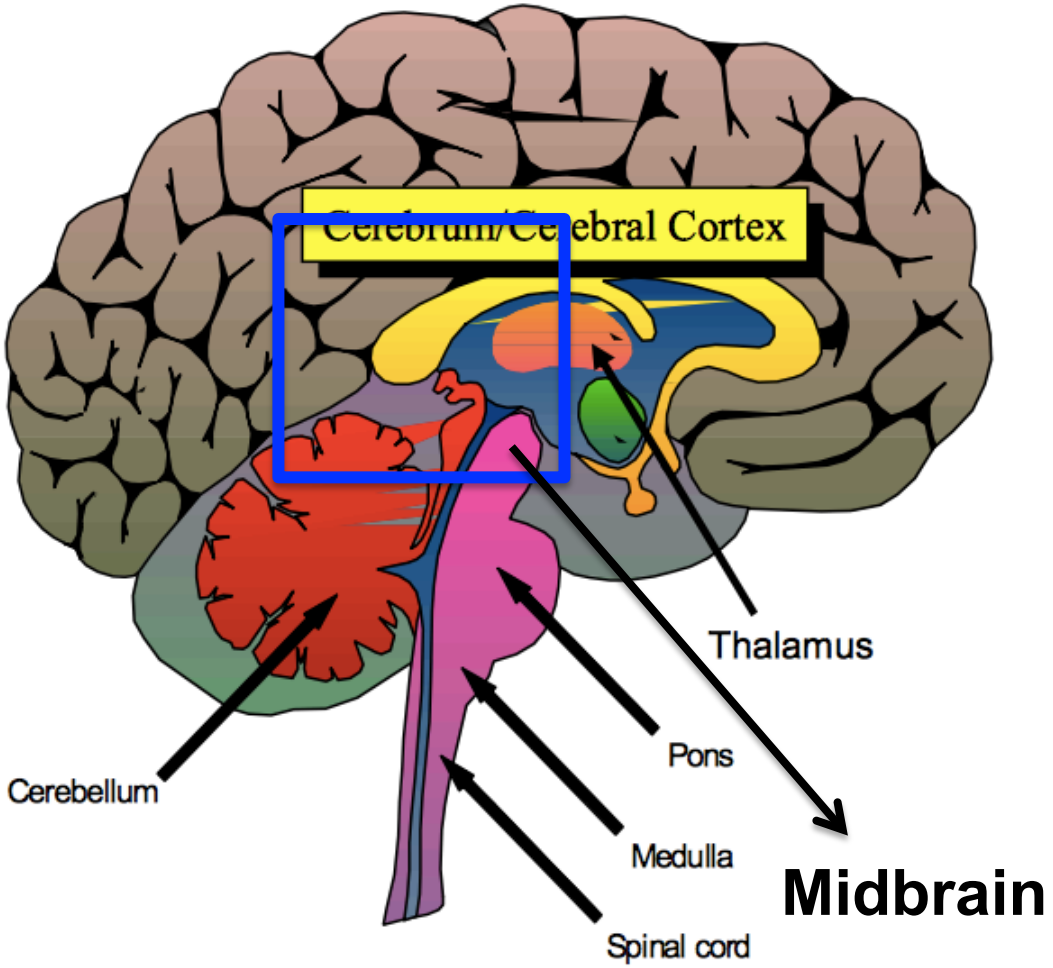


Cerebellum:
Coordination of voluntary movements and sense of equilibrium

Pons:
Connects brainstem with cerebellum and involved in sleep and arousal

Medulla:
Breathing, muscle tone, and blood pressure

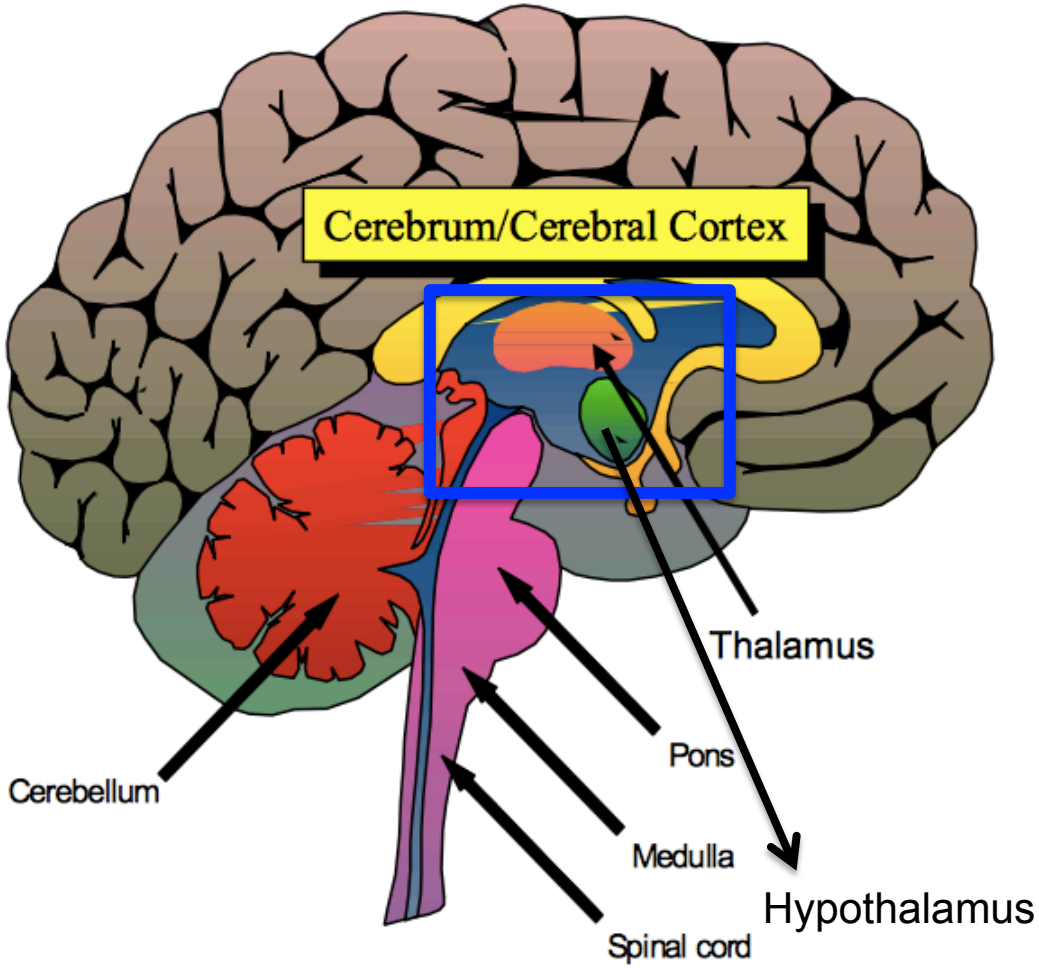
Major Brain Regions: Midbrain and Reticular Formation



Midbrain:
Eye movements, visual, and auditory reflexes

Reticular Formation:
Modulates muscle reflexes, breathing, and pain perception.
Regulates sleep, wakefulness, and arousal.
Not anatomically well-defined (set of nuclei in brainstem).

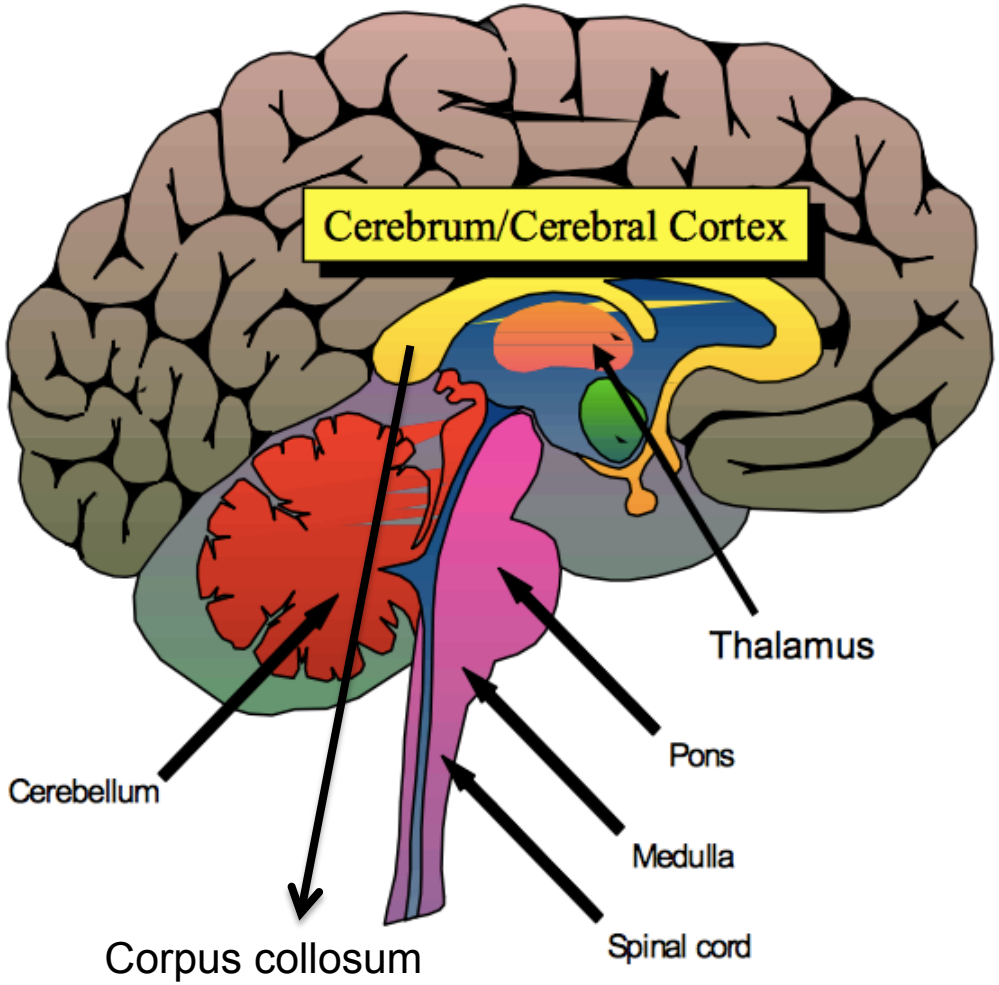
Major Brain Regions: Thalamus and Hypothalamus



Thalamus:
"Relay station" for all sensory information (except smell) to the cortex

Hypothalamus:
Regulates basic needs including fighting, fleeing, feeding, and mating

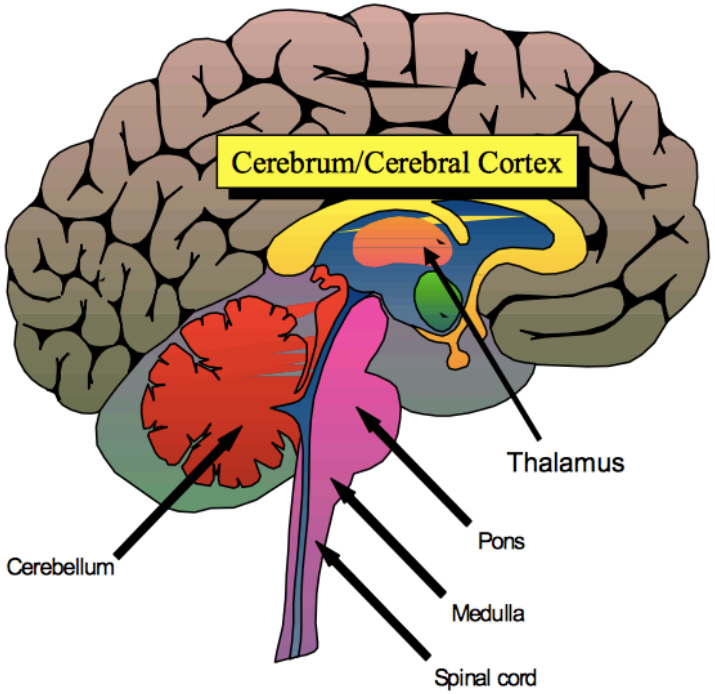
Major Brain Regions: Cerebral Hemispheres

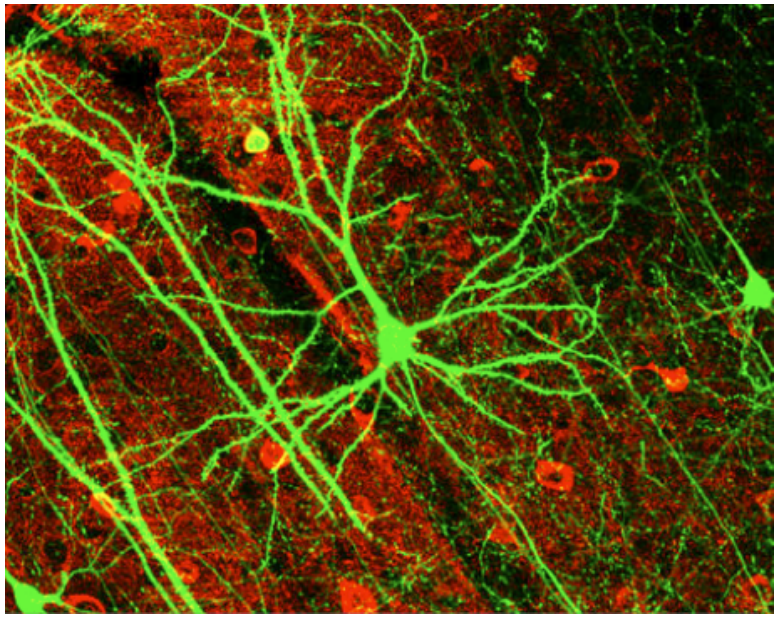


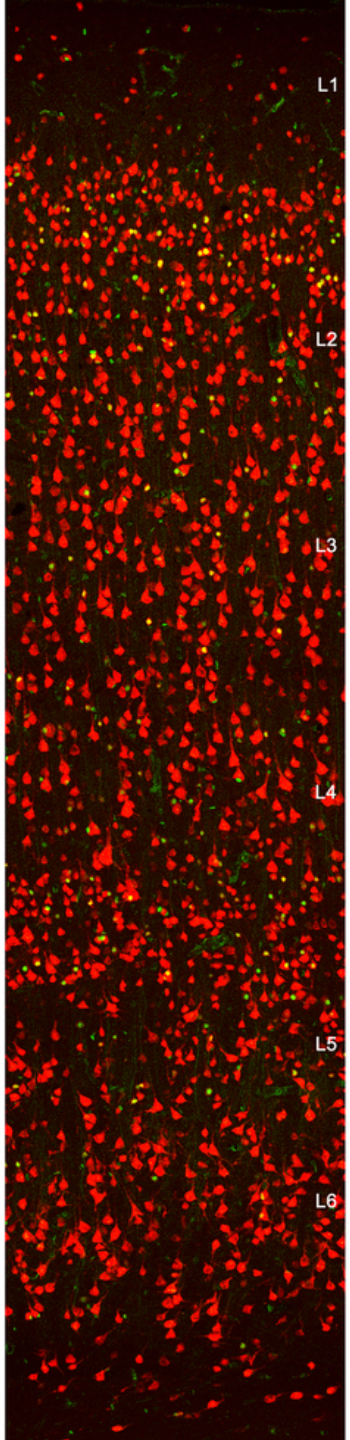
Consists of: cerebral cortex, basal ganglia, hippocampus, and amygdala

Involved in:
Perception and motor control, cognitive functions, emotion, memory and learning

The Neuron



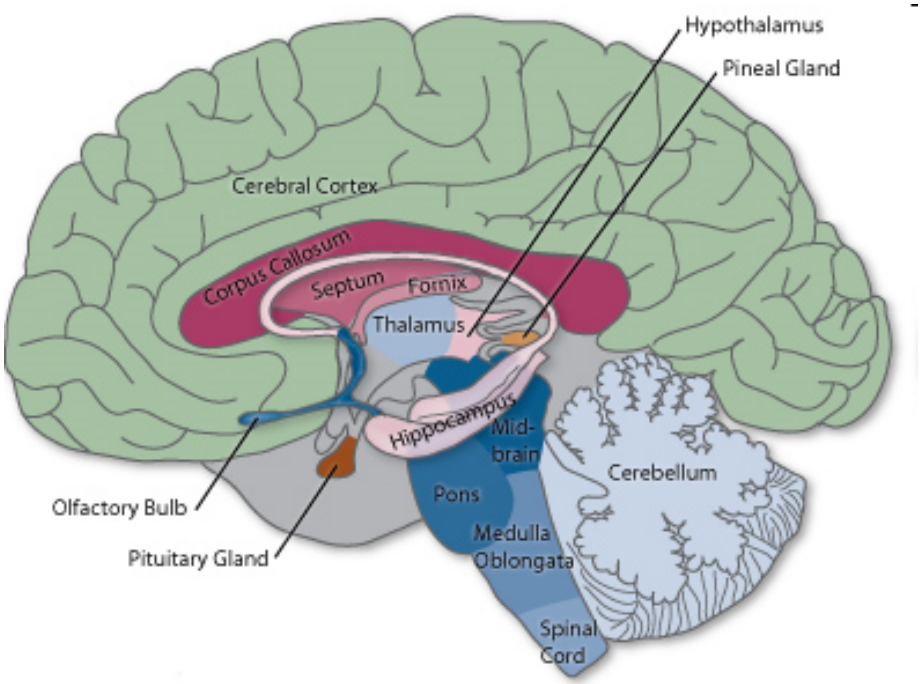


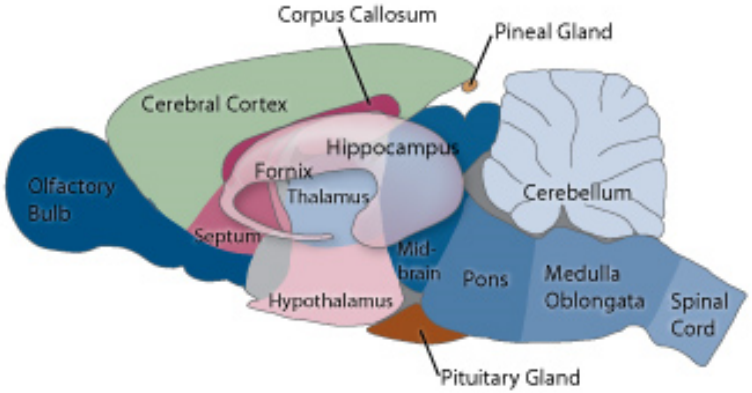


Neo-cortex:
Part of cerebral cortex concerned with sight and hearing in mammals, regarding as the site of higher intelligence ***The neo-cortex has six layers of tissue.***

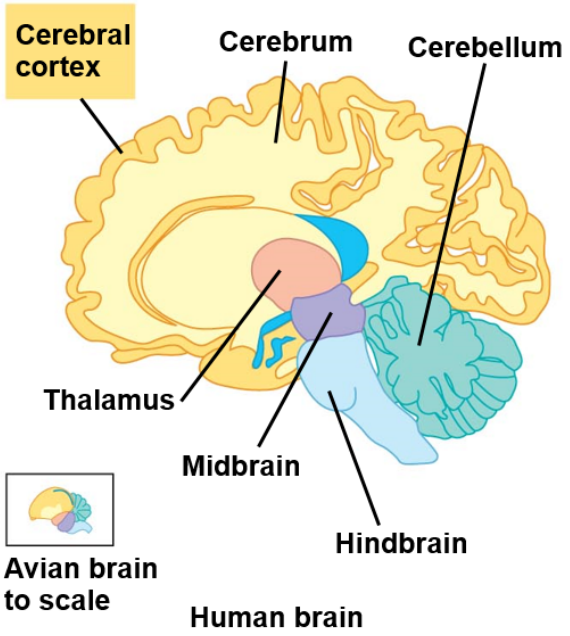
Pyramidal neuron:
Primary component of cortical tissue and named for triangular cell body (soma)

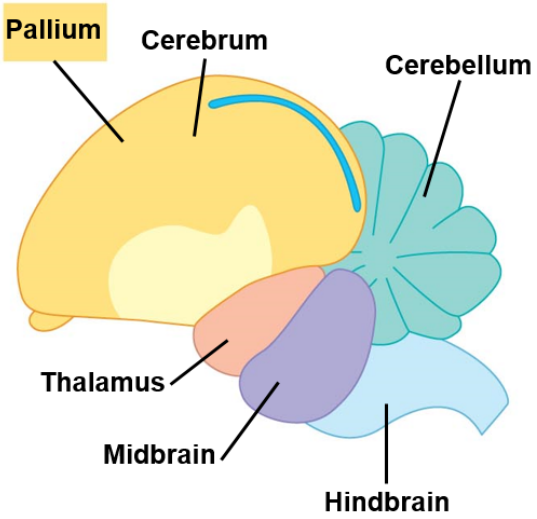
Demo: Brain Bank





Human vs. Rat brain

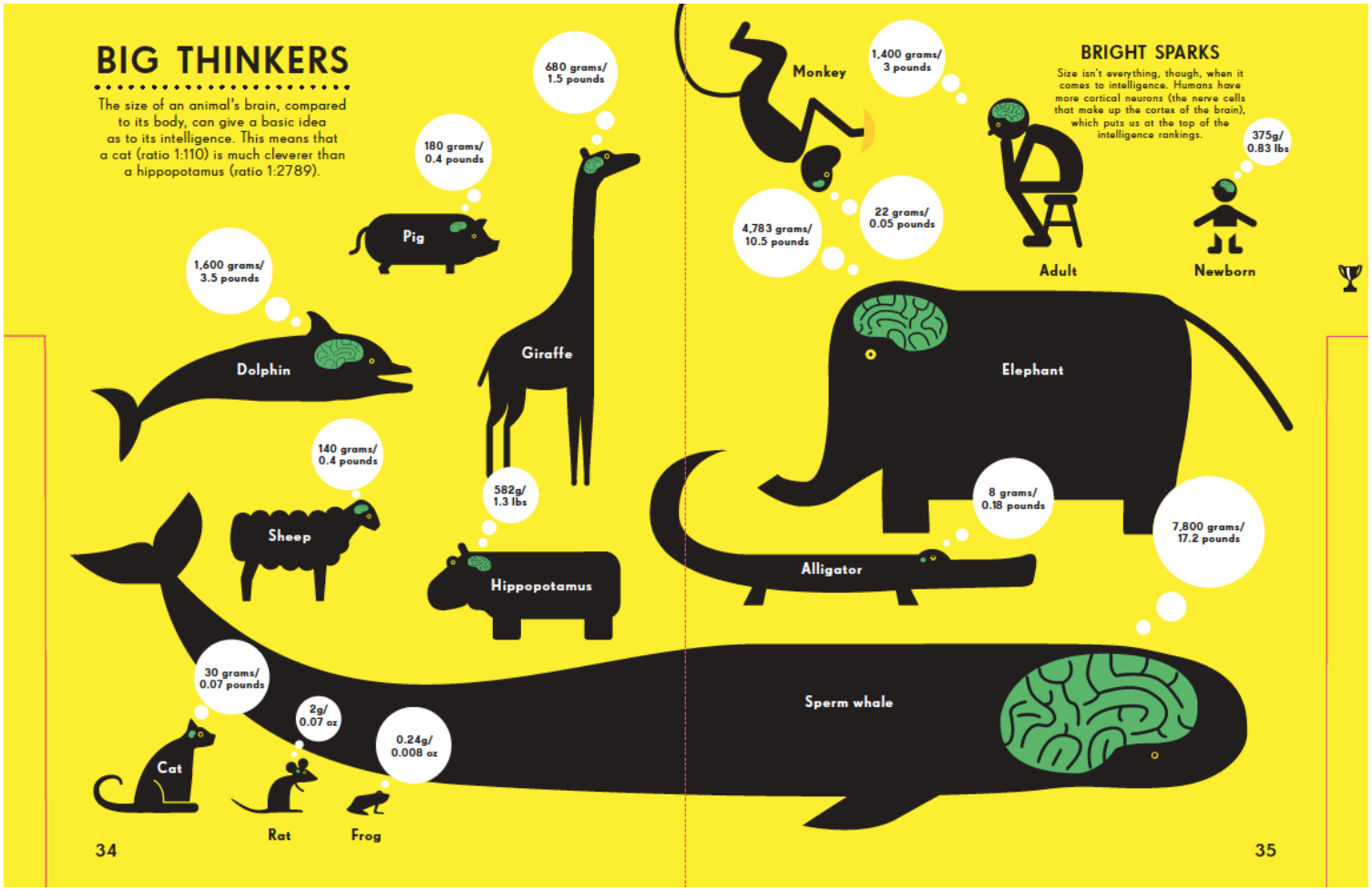




Human vs. Bird brain

Comparing brains in different animals

1. Greater surface area of cerebral cortex allows for more social and complex behaviors, like emotion and language.
2. Different animals have larger areas of their brain dedicated to different regions (take note of size of olfactory bulbs)
3. Proportion of brain region usually dictates importance of that function



Next Time:
Computational Models of Sleep